Policy Analysis of CHP / CCHP

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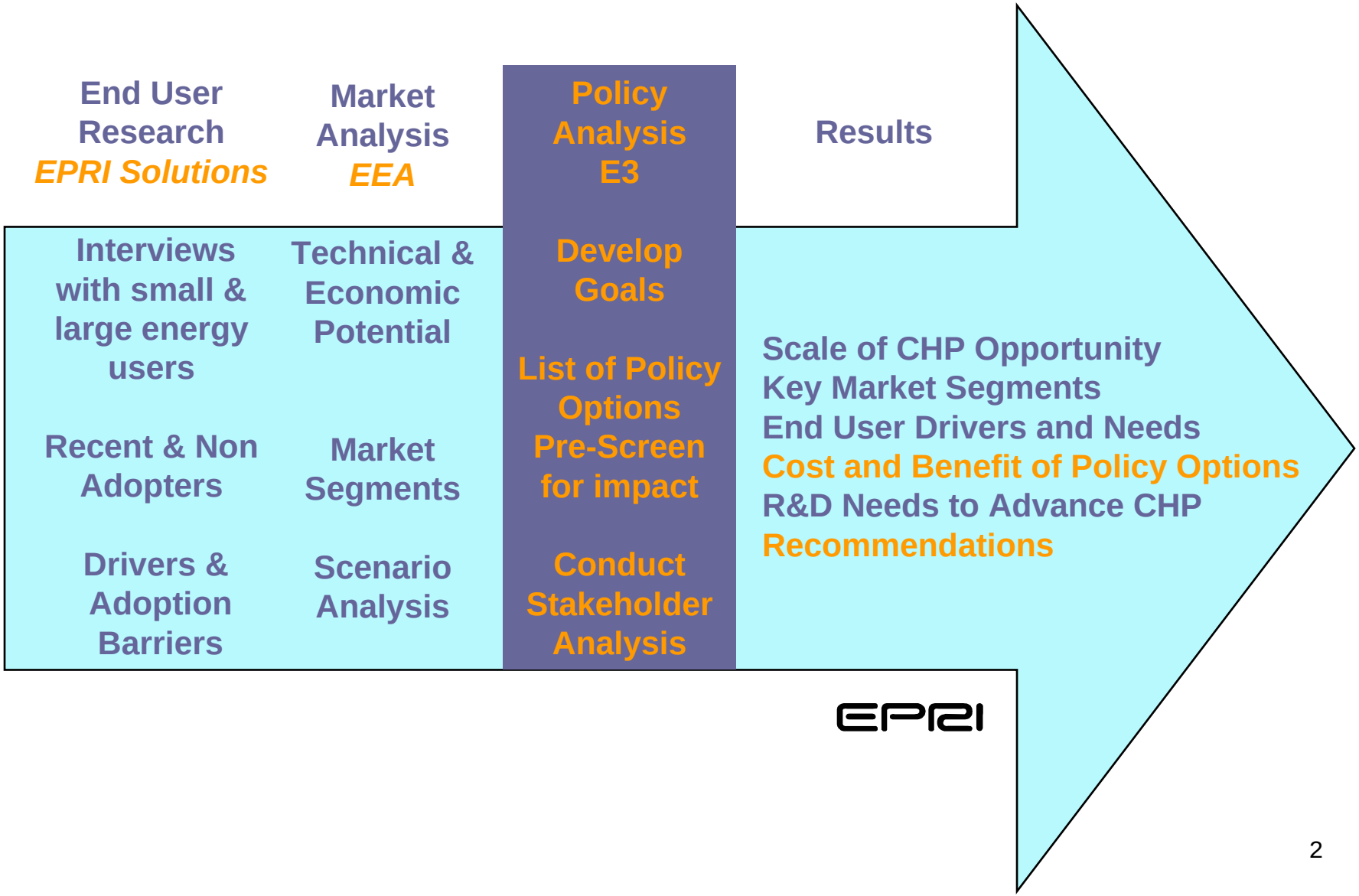
Project Research Approach



Policy Research Approach

- Develop goals of policy analysis
- Develop list of policy options
  - Based on EPRI Solutions research, team experience
- Group policies into ‘portfolios’
- Qualitative / Quantitative analysis
  - EEA economic potential analysis
  - E3 stakeholder analysis - looking for ‘win-win’
- Develop conclusions and R&D research

Desirable Attributes of Policy Options

- Meet stakeholder goals such as:
  - Higher efficiency use of the State's energy resources
  - Positive environmental impact
  - Low impact on utility rates and minimal cost-shifting
- Promote best projects (as defined by stakeholders goals)
- Be relatively easy to implement
- Require low incentive payments
- Have a realistic exit strategy

Develop List of Policy Options

	SGIP Modifications					Resource Adequacy			IOU Incentives					Rate Design Changes			
	Unbundle SGIP Incentives	Increase SGIP Incentives	Renewable CHP Bonus	Faster application processing	Application preparation assistance	Count toward resource adequacy targets	Favorable crediting of CHP capacity	Favorable crediting for RPS	CHP shareholder incentives	ERAM for CHP	CHP program funding	Utility ownership	Market-based bill credit	Net metering w/ and w/o discount	Volumetric Rate	Eliminate exit fees	Rolled-in interconnection
Promote high value CHP (state goal)	X																
Reduce capital cost	X	X	X													X	X
Increase operating benefits													-	X	X		
Reduce hassle (siting/permitting)				X	X							X					
Education (technical knowledge/experience)					X							X					
Resource adequacy value						X	X										
Reduce risk/project uncertainty																	
RPS value								X									
Utility shareholder incentives									X			X					
Lessen utility disincentives										X	X	X	X				

Appendix H of the report contains descriptions of all of the policy ideas developed.

Develop List of Policy Options, cont.

	Marketing and Branding							State Tax		Other Actions					R&D	Portfolio Stds
	Coordinated education effort	Qualified provider list	Certified vendors	Low cost financing	CHP utility audits	Targeted marketing	Information sharing protocol	Tax Credit	Tax credit for suppliers	Streamlined permitting	Subsidized CHP training	CHP infrastructure	Overcome landlord tenant disconnect	Subsidized fuels	R&D Funding	CHP Portfolio Standards
Promote high value CHP (state goal)					X	X		X	X				X			
Reduce capital cost								X	X						X	
Increase operating benefits				X										X	X	
Reduce hassle (siting/permitting)		X	X	X	X		X			X	X	X	X		X	
Education (technical knowledge/experience)	X	X	X		X	X							X			X
Resource adequacy value																X
Reduce risk/project uncertainty			X	X				X								
RPS value																
Utility shareholder incentives																
Lessen utility disincentives									X							X

Policy Portfolio Approach

- Package multiple policies together to attain the widest stakeholder support for CHP/CCHP installations
- Identify ‘core’ policies and suggested additional ‘supplemental’ policies to support implementation of core policies

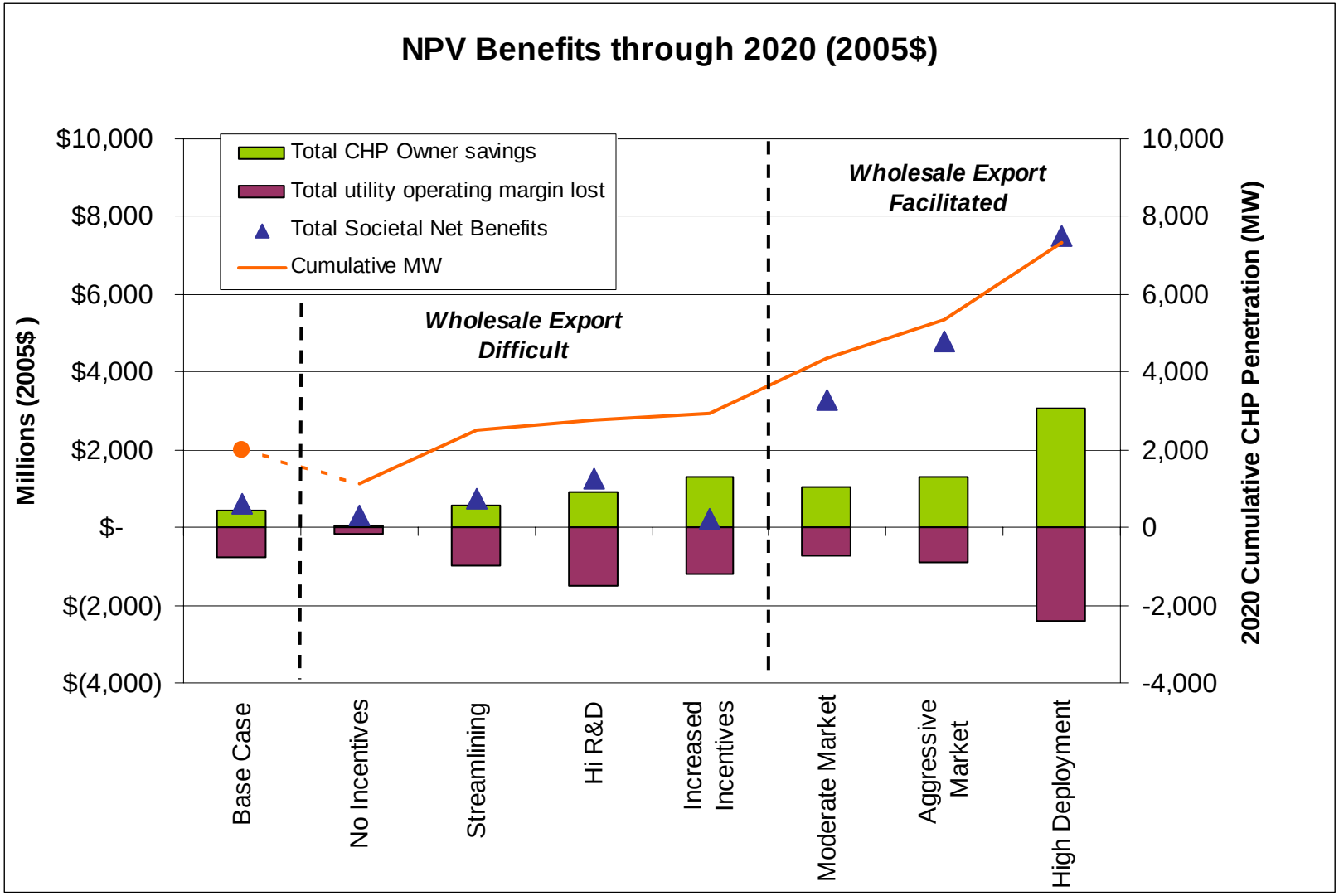
9 Policy Portfolios Examined

1. **Base Case** (no change in existing policy)
2. **No Incentives** (removal of all existing incentives)
3. **Moderate Market Access** (improved access to wholesale energy markets)
4. **Aggressive Market Access** (improved access to wholesale energy markets, and provide mechanism to include CHP for Generation and T&D capacity)
5. **Increasing Incentives** (expanded SGIP and a production tax credit)
6. **Streamlining CHP Installations** (improved customer outreach, simplify permits and interconnection)
7. **Increased R&D Funding** (keep existing policy and focus on technology development)
8. **High Deployment** (Increased R&D Funding + Aggressive Market Access)
9. **Portfolio Standards** (set a target penetration level and adjust incentives, or conduct bidding for payments, until the target is reached)

Quantitative and Qualitative Policy Analyses

- Conducted 2 quantitative analyses
  - Evaluated the penetration of CHP installations of different types under the policy portfolios 1 through 8
  - Evaluated the costs and benefits of an individual CHP installation under a policy portfolio, and summarized the levelized costs and benefits from the CHP owner, utility, and societal perspectives
- Conducted 2 qualitative analyses
  - Stakeholder assessment of several key industry stakeholders
  - Evaluated Portfolio Standard policies

Net Benefits for Each Policy Scenario



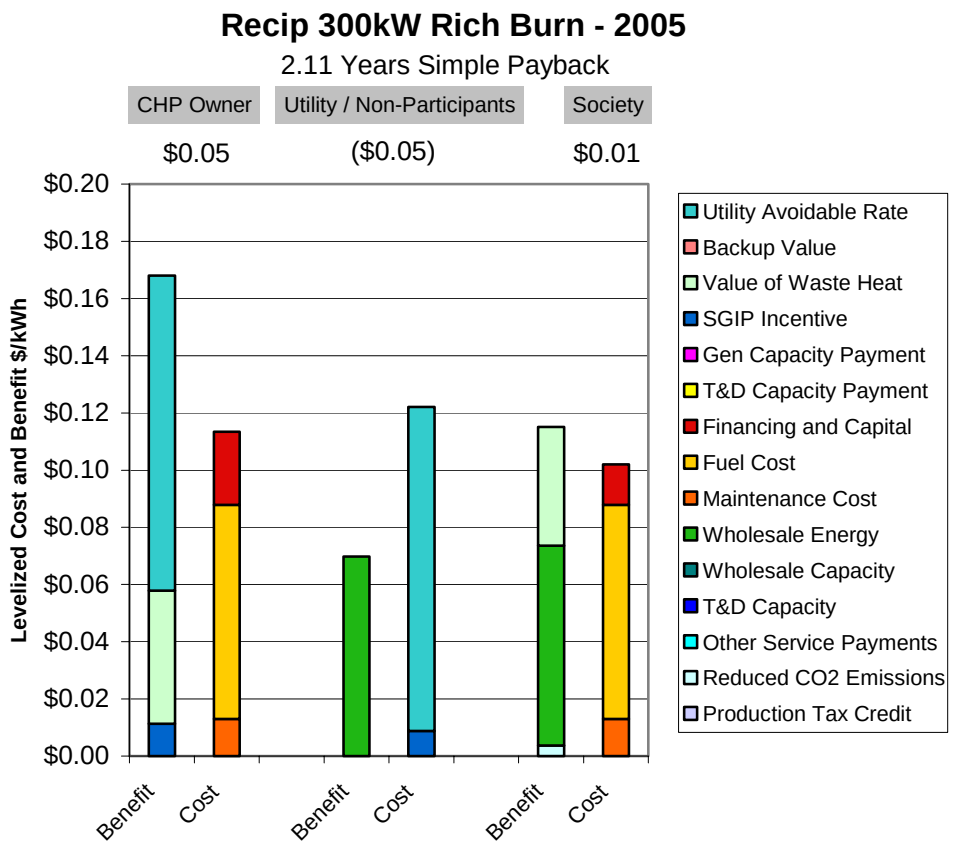
CHP Benefits, Costs, Penetration & CO_2 Impact by Portfolio

Portfolio	NPV through 2020 (in millions)						
	Total CHP Owner savings	Total utility operating margin lost	Total Societal Net Benefits	Total Incentives	Cumulative MW	Total GWh	Total CO2 saved (million tons)
Base Case	$ 451	$ (759)	$ 620	$ 53	1,966	118,031	25
No Incentives	$ 54	$ (183)	$ 306	$ -	1,141	60,140	14
Streamlining	$ 571	$ (1,005)	$ 734	$ 71	2,489	149,832	32
Hi R&D	$ 899	$ (1,485)	$ 1,255	$ 209	2,764	193,635	41
Increased Incentives	$ 1,285	$ (1,183)	$ 201	$ 1,127	2,942	200,579	40
Moderate Market	$ 1,049	$ (720)	$ 3,286	$ 53	4,377	361,260	72
Aggressive Market	$ 1,317	$ (884)	$ 4,791	$ 555	5,348	436,364	83
High Deployment	$ 3,067	$ (2,387)	$ 7,516	$ 1,063	7,340	597,489	120

Example 300kW Recip - Base Case

CHP Cost / Benefit Chart

Recip 300kW Rich Burn - 2005 | SCE | Industrial



Scenarios	1	Description
◉ Base Case		Wholesale gas price + SGIP
○ No Incentives		Retail gas price + No SGIP
○ Aggressive Market Access		Export + T&D + CO2 credit
○ Moderate Market Access		Export
○ Increased Incentives		SGIP Increase + Production Tax

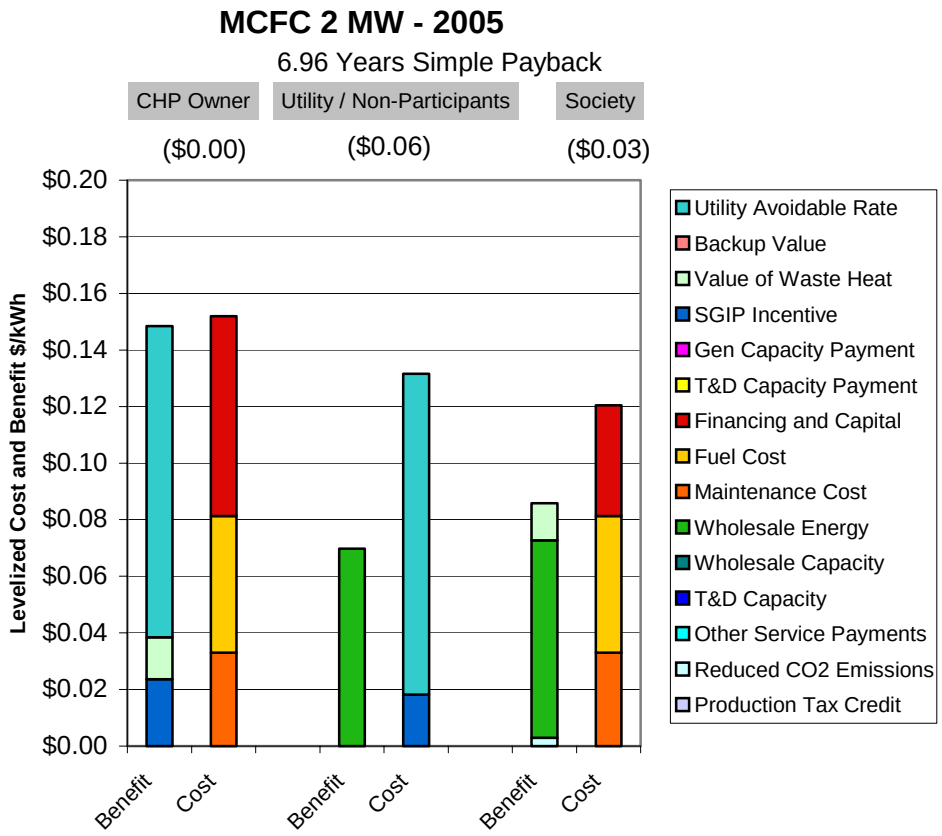
Sensitivities		
$	1,350	CHP Capital Cost $/kW
$	6.51	CHP Fuel Cost $/MMBtu
$	0.065	Wholesale Electricity Price
$	0.013	Maintenance Cost $/kWh
	5,593	Recovered Heat Btu/kWh
$	-	Backup Value $/kW-year
$	-	Generation Capacity
$	-	T&D Capacity
$	8	CO2 Reduction Value $/ton
	50%	Capacity Payment (% of Value)
$	600	SGIP Incentive
	0%	Energy Export
TRUE		Vary Electric Prices with Gas

CHP Rate Sensitivity		
Rate 2: Demand and Energy Charge		Utility Rate Type
$	0.14	Total Average Rate for Class
$	0.08	Energy Charge
$	17.87	Demand Charge
$	-	Reservation Charge
	83%	Demand Charge Avoided
Avoided Rate	$0.110	$/kWh Generated

Example MC Fuel Cell – Base Case

CHP Cost / Benefit Chart

MCFC 2 MW - 2005 | SCE | Industrial



Scenarios	1	Description
(•) Base Case		Wholesale gas price + SGIP
( ) No Incentives		Retail gas price + No SGIP
( ) Aggressive Market Access		Export + T&D + CO2 credit
( ) Moderate Market Access		Export
( ) Increased Incentives		SGIP Increase + Production Tax

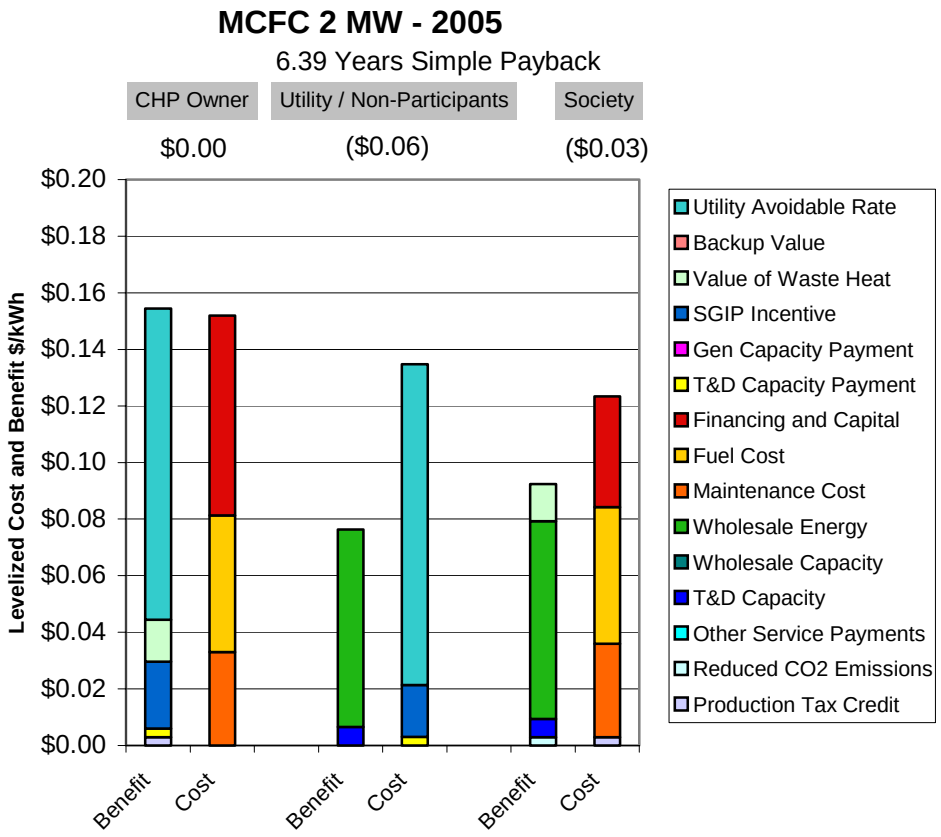
Sensitivities		
$	3,738	CHP Capital Cost $/kW
$	6.51	CHP Fuel Cost $/MMBtu
$	0.065	Wholesale Electricity Price
$	0.033	Maintenance Cost $/kWh
	1,777	Recovered Heat Btu/kWh
$	-	Backup Value $/kW-year
$	-	Generation Capacity
$	-	T&D Capacity
$	8	CO2 Reduction Value $/ton
	50%	Capacity Payment (% of Value)
$	1,250	SGIP Incentive
	0%	Energy Export
TRUE		Vary Electric Prices with Gas

CHP Rate Sensitivity		
Rate 2: Demand and Energy Charge		Utility Rate Type
$	0.14	Total Average Rate for Class
$	0.08	Energy Charge
$	17.87	Demand Charge
$	-	Reservation Charge
	83%	Demand Charge Avoided
Avoided Rate	$0.110	$/kWh Generated

Example MC Fuel Cell – Aggressive Market Access

CHP Cost / Benefit Chart

MCFC 2 MW - 2005 | SCE | Industrial



Scenarios	3	Description
○ Base Case		Wholesale gas price + SGIP
○ No Incentives		Retail gas price + No SGIP
◉ Aggressive Market Access		Export + T&D + CO2 credit
○ Moderate Market Access		Export
○ Increased Incentives		SGIP Increase + Production Tax

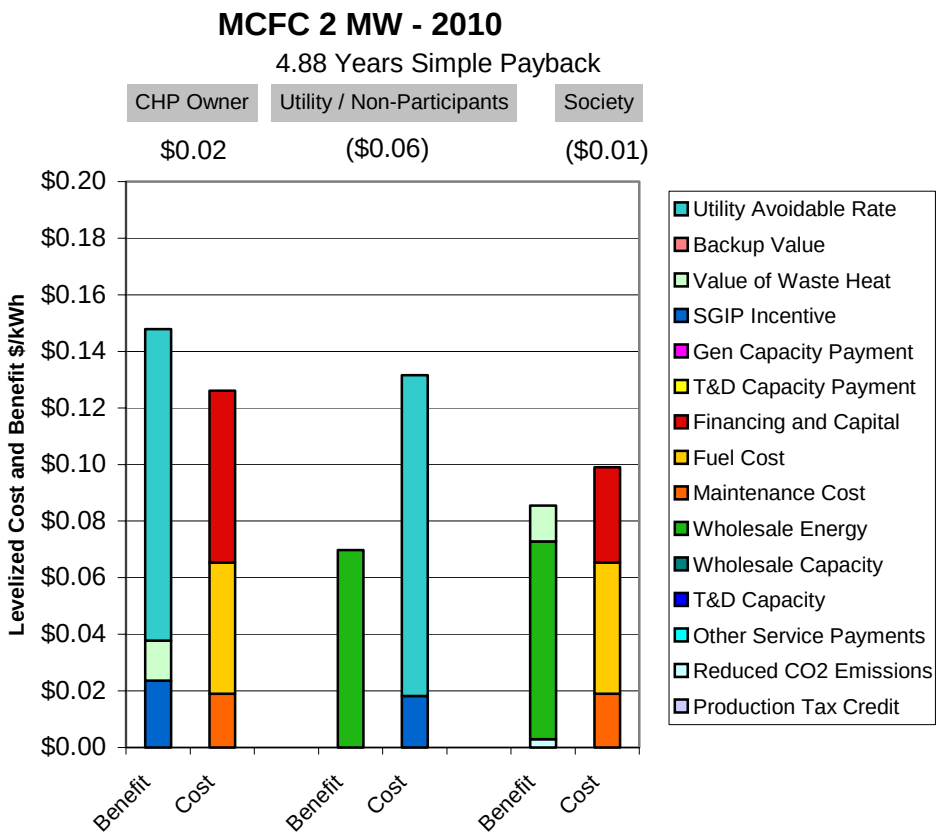
Sensitivities		
$	3,738	CHP Capital Cost $/kW
$	6.51	CHP Fuel Cost $/MMBtu
$	0.065	Wholesale Electricity Price
$	0.033	Maintenance Cost $/kWh
	1,777	Recovered Heat Btu/kWh
$	-	Backup Value $/kW-year
$	-	Generation Capacity
$	40	T&D Capacity
$	8	CO2 Reduction Value $/ton
	50%	Capacity Payment (% of Value)
$	1,250	SGIP Incentive
	0%	Energy Export
TRUE		Vary Electric Prices with Gas

CHP Rate Sensitivity		
Rate 2: Demand and Energy Charge		Utility Rate Type
$	0.14	Total Average Rate for Class
$	0.08	Energy Charge
$	17.87	Demand Charge
$	-	Reservation Charge
	83%	Demand Charge Avoided
Avoided Rate	$0.110	$/kWh Generated

Example MC Fuel Cell 2010 Base Case

CHP Cost / Benefit Chart

MCFC 2 MW - 2010 | SCE | Industrial



Scenarios	1	Description
(•) Base Case		Wholesale gas price + SGIP
( ) No Incentives		Retail gas price + No SGIP
( ) Aggressive Market Access		Export + T&D + CO2 credit
( ) Moderate Market Access		Export
( ) Increased Incentives		SGIP Increase + Production Tax

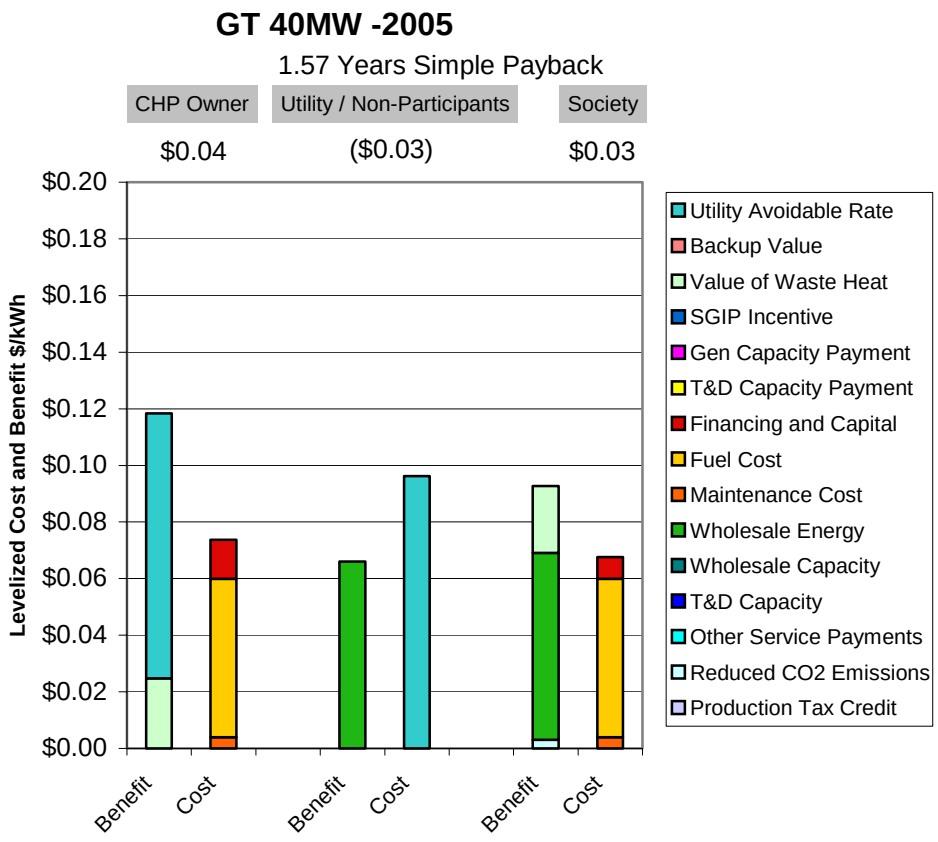
Sensitivities			
	$	3,220	CHP Capital Cost $/kW
	$	6.51	CHP Fuel Cost $/MMBtu
	$	0.065	Wholesale Electricity Price
	$	0.019	Maintenance Cost $/kWh
		1,706	Recovered Heat Btu/kWh
	$	-	Backup Value $/kW-year
	$	-	Generation Capacity
	$	-	T&D Capacity
	$	8	CO2 Reduction Value $/ton
		50%	Capacity Payment (% of Value)
	$	1,250	SGIP Incentive
		0%	Energy Export
		TRUE	Vary Electric Prices with Gas

CHP Rate Sensitivity			
Rate 2: Demand and Energy Charge			Utility Rate Type
	$	0.14	Total Average Rate for Class
	$	0.08	Energy Charge
	$	17.87	Demand Charge
	$	-	Reservation Charge
		83%	Demand Charge Avoided
Avoided Rate		$0.110	$/kWh Generated

Example 40MW CT – 2005 – Base Case

CHP Cost / Benefit Chart

GT 40MW -2005 | PG&E | Primary



Scenarios	1	Description
◉ Base Case		Wholesale gas price + SGIP
○ No Incentives		Retail gas price + No SGIP
○ Aggressive Market Access		Export + T&D + CO2 credit
○ Moderate Market Access		Export
○ Increased Incentives		SGIP Increase + Production Tax

Sensitivities		
$ 735		CHP Capital Cost $/kW
$ 6.06		CHP Fuel Cost $/MMBtu
$ 0.062		Wholesale Electricity Price
$ 0.004		Maintenance Cost $/kWh
3,189		Recovered Heat Btu/kWh
$ -		Backup Value $/kW-year
$ -		Generation Capacity
$ -		T&D Capacity
$ 8		CO2 Reduction Value $/ton
50%		Capacity Payment (% of Value)
$ -		SGIP Incentive
0%		Energy Export
TRUE		Vary Electric Prices with Gas

CHP Rate Sensitivity		
Rate 2: Demand and Energy Charge		Utility Rate Type
$ 0.10		Total Average Rate for Class
$ 0.08		Energy Charge
$ 5.24		Demand Charge
$ -		Reservation Charge
83%		Demand Charge Avoided
Avoided Rate	$0.094	$/kWh Generated

Note: This figure is not in the draft report - but included here per several requests.

Perspectives of CHP Key Market Stakeholders in Policy Analysis

Customer/ CHP Owner	Utility/ Non-Participants	State/ Society	Small User Advocate	Ratepayer Advocate
The customer's primary concern is to reduce electricity costs and maintain reliability.	The utility's primary concern is to achieve earnings targets and avoid rate increases associated with behind-the-meter CHP installations.	The society is concerned with the least cost solution with the least environmental impact.	The small user advocate is concerned with rate impacts on the small customers of California's utilities. (Similar to the positions of TURN and UCAN.)	The ratepayer advocate is concerned with keeping electric rates fair and low and promoting customer choice in energy decisions. (Similar to the position of ORA.)

Stakeholder Perspective Analysis by Portfolio

Moderate Market Access Portfolio	Participants	Utility	State	Small-User Advocate	Ratepayer Advocate
Existing Policies					
Maintain SGIP Incentives					
Maintain CHP qualification for UEG Gas Tariff					
Core Policies					
Wholesale Energy Export	Y	M	Y	Y	Y

Aggressive Market Access Portfolio	Participants	Utility	State	Small-User Advocate	Ratepayer Advocate
Existing Policies					
Maintain SGIP Incentives					
Maintain CHP qualification for UEG Gas Tariff					
Core Policies					
Wholesale Energy Export	Y	M	Y	Y	Y
T&D Capacity Support Payments	Y	M	Y	M	M
CO2 Credit of $8 per ton CO2 Saved	Y	M	Y	?	?

Increasing Incentives Portfolio	Participants	Utility	State	Small-User Advocate	Ratepayer Advocate
Existing Policies					
Increase SGIP Incentives	Y	M	Y	N	M
Maintain CHP qualification for UEG Gas Tariff					
Core Policies					
Partial pass through of interconnection costs	Y	M	Y	M	M
State tax credits (production tax credit)	Y	Y	M	--	--
State tax credits (capital cost credit)	Y	Y	M	--	--

Stakeholder Perspective Analysis by Portfolio (continued)

Streamlining CHP Installations Portfolio	Participants	Utility	State	Small-User Advocate	Ratepayer Advocate
Existing Policies					
Increase SGIP Incentives Maintain CHP qualification for UEG Gas Tariff	Y	M	Y	N	M
Core Policies					
Education programs	Y	Y	Y		
Target marketing to the right customers	Y	M	Y		Y
Overcoming landlord/tenant barriers	Y	M	Y		Y
Free CHP assessment and auditing	Y	M	Y		Y
CEC vendor certification	Y	Y	M		
LSE qualified vendor list	Y	M	Y		

R&D Portfolio	Participants	Utility	State	Small-User Advocate	Ratepayer Advocate
Existing Policies					
Maintain SGIP Incentives Maintain CHP qualification for UEG Gas Tariff					
Core Policies					
Increased R&D Funding	Y	M	M	--	--

Stakeholder Perspective Analysis by Portfolio (continued)

High Deployment Portfolio	Participants	Utility	State	Small-User Advocate	Ratepayer Advocate
Existing Policies					
Maintain SGIP Incentives					
Maintain CHP qualification for UEG Gas Tariff					
Core Policies					
Wholesale Energy Export	Y	M	Y	Y	Y
T&D Capacity Support Payments	Y	M	Y	M	M
CO2 Credit of $8 per ton CO2 Saved	Y	M	Y	?	?
Increased R&D Funding	Y	M	M	--	--
Education programs	Y	Y	Y		
Target marketing to the right customers	Y	M	Y		Y
Overcoming landlord/tenant barriers	Y	M	Y		Y
Free CHP assessment and auditing	Y	M	Y		Y
CEC vendor certification	Y	Y	M		
LSE qualified vendor list	Y	M	Y		

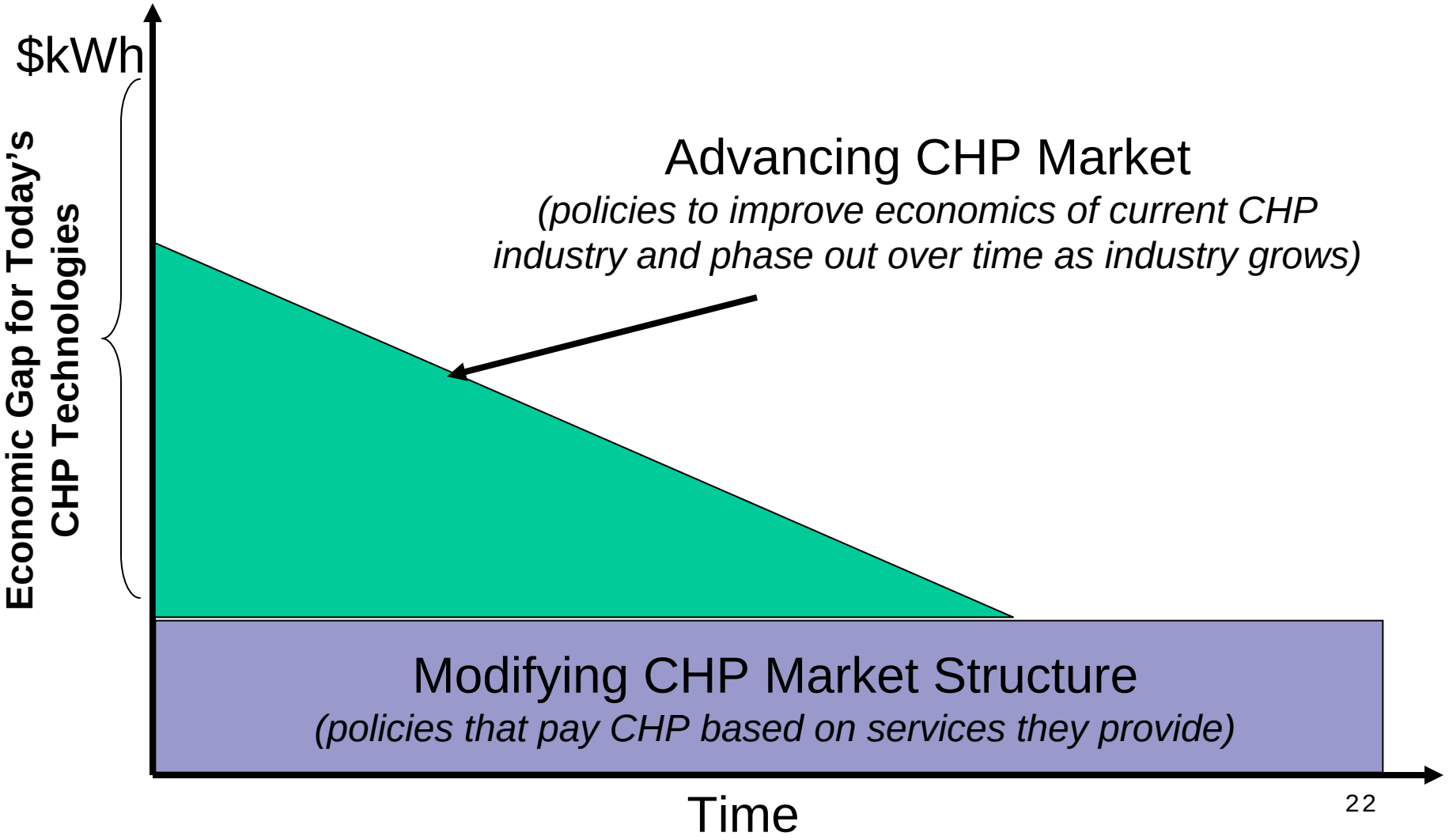
Portfolio Standards for CHP	Participants	Utility	State	Small-User Advocate	Ratepayer Advocate
Existing Policies					
Maintain SGIP Incentives					
Maintain CHP qualification for UEG Gas Tariff					
Core Policies					
Statewide CHP portfolio standards	Y	N	M	--	M

Portfolio Standard Pros & Cons

- Approach: Set a target level of penetration and let the incentive vary to reach the goals
- Pros:
  - Prevents an incentive level that overpays CHP installations by creating a competitive bid for payments
- Cons:
  - Developing the competitive mechanism is difficult
    - e.g. Who is responsible for reaching the target?
  - Requires specification of the ‘right’ amount of CHP – a difficult task – especially given volatile natural gas prices
  - Portfolio Standard is an incentive-focused policy and does not focus on payments to CHP for the value it provides the system

Exit Strategy for ‘Subsidies’

The results of the stakeholder analysis will likely yield two types of policy options from which a comprehensive CHP strategy can be developed.



Policy Analysis Conclusions (1)

- Export at wholesale energy prices could encourage new very large CHP installations.
  - Significant production at higher efficiency than central station plants.
- All policy options result in losses in electric utility revenue greater savings to the utility.
  - Participation in energy and capacity markets, as well as T&D capacity, tends to mitigate the utility losses.

Policy Analysis Conclusions (2)

- Increasing incentives to encourage more CHP adoption alone decreases the societal benefits from CHP installations and exacerbates the losses to the utility and non-participating customers.

Take-away Recommendations

- Support policies that encourage operation of CHP to capture both customer- and utility-system side benefits
- Pay for utility-system services based on the value they provide
- Define an exit strategy that ramps down ‘subsidies’ over time as technology costs improve